

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (currently amended) A pump device, comprising:

a) a pump housing with an inlet, an outlet, and a fluid passage through which a fluid can pass; and

~~b) means for both transferring rotational momentum to the fluid by viscous forces and imparting centrifugal forces to the fluid, including a mechanism selected from the group consisting of:~~

~~1) a wiper extending partially across at least one rotatable disc surface of at least one rotatable disc; and~~

~~2) a rotatable shaft with a hollow cavity extending from one end to at least one slot extending radially from the hollow cavity~~

b) at least one rotatable disc rotatably disposed in the pump housing, having a rotatable disc surface for transferring rotational momentum to the fluid by viscous forces and imparting centrifugal forces to the fluid;

c) a wiper extending across a portion of the rotatable disc surface; and

d) the disc surface, inlet, outlet, and fluid passage being oriented parallel to one another to form a planar structure through which a fluid can pass with the rotatable disc surface rotatable parallel to the flow of fluid through the planar structure.

2. (currently amended) A device in accordance with claim 1, wherein the disc surface includes ~~at least one~~ a feature selected from the group consisting of:

at least one channel, extending into the disc surface, and oriented radially with respect to an axis of rotation of the rotatable disc;

at least one ridge, extending from the disc surface, and oriented radially with respect to an axis of rotation of the rotatable disc;

a plurality of dimples extending into the disc surface;

a plurality of dimples, extending into the disc surface, and positioned in a linear array oriented radially with respect to an axis of rotation of the rotatable disc;

at least one arcuate blade, extending from the disc surface, and oriented in a spiral

about an axis of rotation of the disc;

at least one arcuate channel, extending into the disc surface, and oriented in a spiral about an axis of rotation of the disc;

a cone shape with a longitudinal axis collinear with an axis of rotation of the disc;

a curved shape with a longitudinal axis collinear with an axis of rotation of the disc;

a random surface roughness; and

a patterned surface roughness.

3. (currently amended) A device in accordance with claim 1, wherein the wiper includes ~~at least one~~ a feature selected from the group consisting of:

at least one channel or indentation, extending into a leading or trailing edge of the wiper;

at least one ridge or protrusion, extending from a leading or trailing edge of the wiper;

at least one ridge or protrusion, extending from the wiper in a direction away from the rotatable disc surface;

at least one channel or indentation, extending into the wiper opposite the rotatable disc surface;

a leading or trailing edge extending across the disc a distance greater than a radius of the rotatable disc surface;

a leading or trailing edge extending across the disc a distance less than a radius of the rotatable disc surface;

a leading or trailing edge with a curvature in a plane parallel with the rotatable disc surface or orthogonal to an axis of rotation of the rotatable disc surface;

leading and trailing edges extending orthogonal to one another;

leading and trailing edges extending at an acute angle to one another;

leading and trailing edges with a convex curvature therebetween;

leading and trailing edges with a concave curvature therebetween;

a position extending across an axis of rotation of the disc;

a position extending aside from an axis of rotation of the disc;
a leading or trailing edge perpendicular to the rotatable disc surface; and
a leading or trailing edge at an inclined angle with respect to the rotatable disc surface.

4. (original) A device in accordance with claim 1, further comprising:

- a) a pair of spaced-apart rotatable discs, rotatably disposed in the pump housing, with opposing rotatable disc surfaces; and
- b) the wiper being disposed between the spaced-apart rotatable discs.

5. (currently amended) A device in accordance with claim 4, wherein the pair of spaced-apart rotatable discs include ~~at least one~~ a feature selected from the group consisting of:

- the opposing rotatable disc surfaces having a same surface roughness;
- the opposing rotatable disc surfaces having different surface roughnesses;
- the opposing rotatable disc surfaces being parallel;
- the opposing rotatable disc surfaces being non-parallel;
- at least one of the rotatable disc surfaces being planar;
- at least one of the rotatable disc surfaces being non-planar;
- the opposing rotatable disc surfaces being planar;
- the opposing rotatable disc surfaces being non-planar;
- a common shaft interconnecting the rotatable discs;
- interconnected to rotate together at the same speed;
- rotatable at different speeds; and
- different diameters.

6. (original) A device in accordance with claim 1, further comprising an inlet passage disposed between the inlet of the housing and the disc surface, and an outlet passage disposed between the disc surface and the outlet of the housing; the inlet and outlet passages having an orientation selected from the group consisting of: parallel with the disc surface; perpendicular to the disc surface; and inclined with respect to the disc surface.

7. (original) A device in accordance with claim 1, further comprising:
- a) a motor, operatively coupled to the at least one rotatable disc;
 - b) an opposing wall, opposing the wiper, with the wiper, the opposing wall and the rotatable disc together defining at least a portion of the fluid passage.

Claims 8-14. (Canceled).

15. (currently amended) A pump device, comprising:
- a) a pump housing with an inlet, an outlet, and a fluid passage through which a fluid can pass;
 - b) at least one disc, rotatably disposed in the pump housing, having a rotatable disc surface;
 - c) a wiper, extending across a portion of the rotatable disc surface;
 - d) an opposing wall, opposing the wiper, with the wiper, the opposing wall and the disc together defining at least a portion of the fluid passage; and
 - e) the inlet, the outlet, the fluid passage, and the disc surface forming a substantially planar flow structure to direct fluid flow parallel to the rotational disc surface ~~a motor, operatively coupled to the disc.~~
16. (currently amended) A pump device, comprising:
- a) a pump housing;
 - b) a rotatable shaft, rotatably disposed in the housing;
 - c) a hollow cavity, formed in the shaft;
 - d) an aperture formed in an end of the shaft defining an inlet to the hollow cavity;
 - e) a plurality of slots, formed in the shaft and extending from an outer surface of the shaft to the hollow cavity and defining a fluid passage and an outlet from the hollow cavity, and defining a plurality of impeller blades between the plurality of slots and within a circumference of the shaft; and
 - f) an inner rotating surface of the shaft including means for transferring rotational

momentum to the fluid by viscous forces and imparting centrifugal forces to the fluid at
~~least one bearing, carrying the shaft and disposed between the housing and the shaft.~~

17. (original) A device in accordance with claim 16, further comprising:

- a) a pair of bearings disposed on opposite sides of the plurality of slots;
- b) an intermediate member, disposed between the pair of bearings and around the plurality of slots, having a cavity defining a volute that extends uninterrupted to an outlet;
and
- c) a motor, operatively coupled to the shaft.

18. (new) A device in accordance with claim 16, wherein the inner surface has a feature selected from the group consisting of:

- a straight, constant diameter bore oriented concentric with an axis of rotation of the shaft;
- a tapered bore with a straight wall in cross-section along an axis of rotation of the shaft;
- a tapered bore with a curved wall in cross-section along an axis of rotation of the shaft;
- at least one ridge, extending from the inner surface, and oriented parallel with an axis of rotation of the shaft;
- at least one channel, extending into the inner surface, and oriented parallel with an axis of rotation of the shaft;
- a plurality of spiral blades, extending from the inner surface;
- a random surface roughness; and
- a patterned surface roughness.

19. (new) A device in accordance with claim 16, wherein the at least one slot includes a feature selected from the group consisting of:

- a plurality of slots laterally adjacent one another and disposed circumferentially around the shaft; and

a plurality of slots longitudinally adjacent one another along a length of the shaft.

20. (new) A device in accordance with claim 16, further comprising:

a portion of the shaft laterally adjacent to the slot defining an impeller blade formed within a circumference of the shaft.

21. (new) A device in accordance with claim 20, wherein the at least one impeller blade includes a feature selected from the group consisting of:

a plurality of impeller blades laterally adjacent one another and disposed circumferentially around the shaft;

a plurality of impeller blades longitudinally adjacent one another along a length of the shaft;

a leading or trailing edge that is flat and oriented parallel with an axis of rotation of the shaft;

a leading or trailing edge with a concave curvature;

a plurality of impeller blades with leading or trailing edges having a same surface roughness;

a plurality of curvilinear impeller blades with a curvature in a plane perpendicular to the axis of rotation of the shaft;

a plurality of impeller blades with leading or trailing edges of different surface roughness; and

an impeller blade extending into the hollow interior.

22. (new) A device in accordance with claim 16, further comprising:

an end surface of the hollow cavity proximate the at least one slot having a protrusion to guide flow to the at least one slot.

23. (new) A device in accordance with claim 1, further comprising:

a volute, disposed around the shaft at the at least one slot.

24. (new) A device in accordance with claim 1, further comprising:
- a) a motor, operatively coupled to the shaft;
 - b) a pair of bearings, carrying the shaft and disposed on opposite sides of the at least one slot; and
 - c) an intermediate member, disposed between the pair of bearings, defining a volute around the shaft at the at least one slot.
25. (new) A pump device, comprising:
- a) a pump housing with an inlet, an outlet, and a fluid passage through which a fluid can pass; and
 - b) at least one rotatable member rotatably disposed in the pump housing, having a rotatable surface defining at least a portion of the fluid passage and including a surface feature for transferring rotational momentum to the fluid by viscous forces and imparting centrifugal forces to the fluid.
26. (new) A device in accordance with claim 25, wherein the at least one rotatable member is a rotatable disc and the surface feature is selected from the group consisting of
- at least one channel, extending into the disc surface, and oriented radially with respect to an axis of rotation of the rotatable disc;
 - at least one ridge, extending from the disc surface, and oriented radially with respect to an axis of rotation of the rotatable disc;
 - a plurality of dimples extending into the disc surface;
 - a plurality of dimples, extending into the disc surface, and positioned in a linear array oriented radially with respect to an axis of rotation of the rotatable disc;
 - at least one arcuate blade, extending from the disc surface, and oriented in a spiral about an axis of rotation of the disc;
 - at least one arcuate channel, extending into the disc surface, and oriented in a spiral about an axis of rotation of the disc;
 - a cone shape with a longitudinal axis collinear with an axis of rotation of the disc;
 - a curved shape with a longitudinal axis collinear with an axis of rotation of the

disc;

a random surface roughness; and

a patterned surface roughness.

27. (new) A device in accordance with claim 25, wherein the at least one rotatable member is a rotatable hollow shaft having an inner rotatable surface, and the surface feature is selected from the group consisting of

a straight, constant diameter bore oriented concentric with an axis of rotation of the shaft;

a tapered bore with a straight wall in cross-section along an axis of rotation of the shaft;

a tapered bore with a curved wall in cross-section along an axis of rotation of the shaft;

at least one ridge, extending from the inner surface, and oriented parallel with an axis of rotation of the shaft;

at least one channel, extending into the inner surface, and oriented parallel with an axis of rotation of the shaft;

a plurality of spiral blades, extending from the inner surface;

a random surface roughness; and

a patterned surface roughness.